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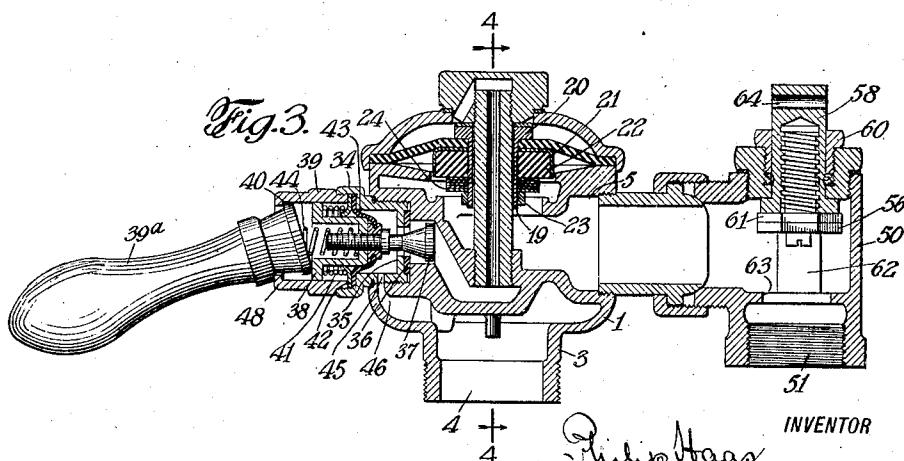
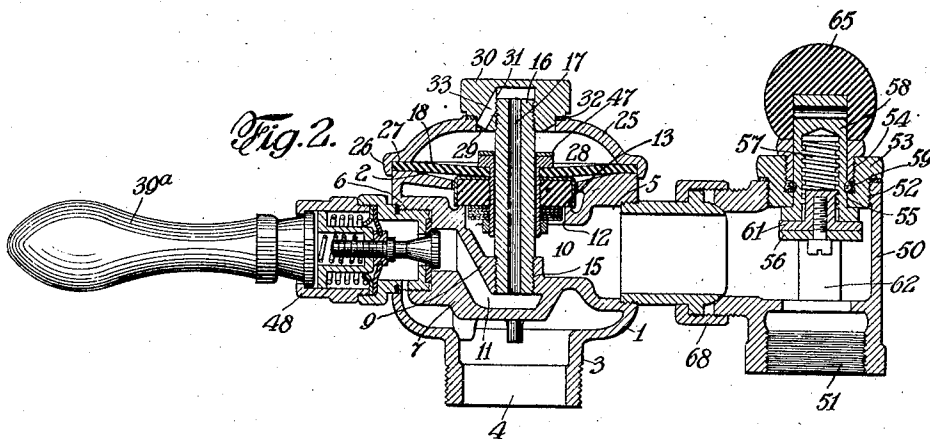
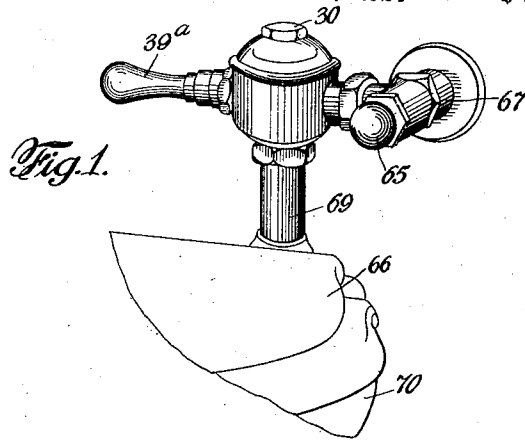
P. HAAS

1,614,468

HYDRAULICALLY OPERATED FLUSHING VALVE MECHANISM

Filed June 5, 1924

2 Sheets-Sheet 1



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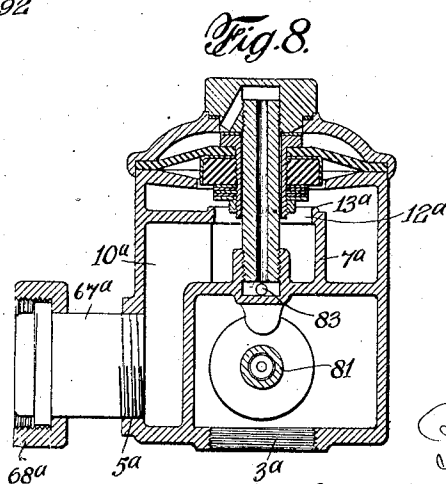
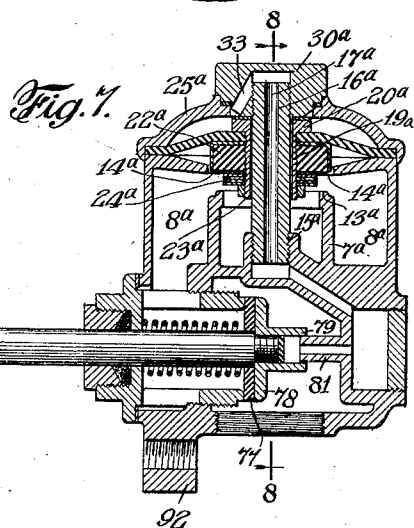
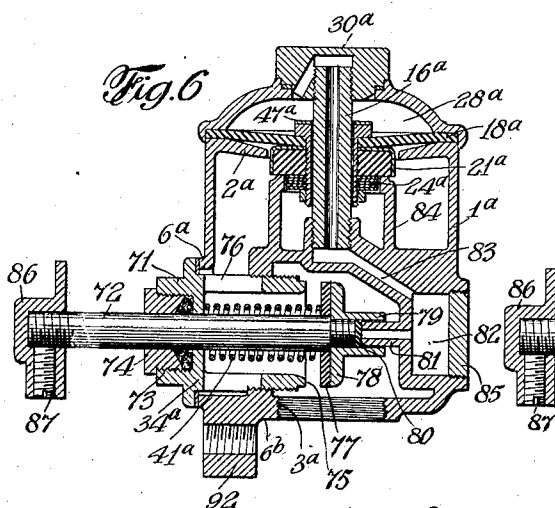
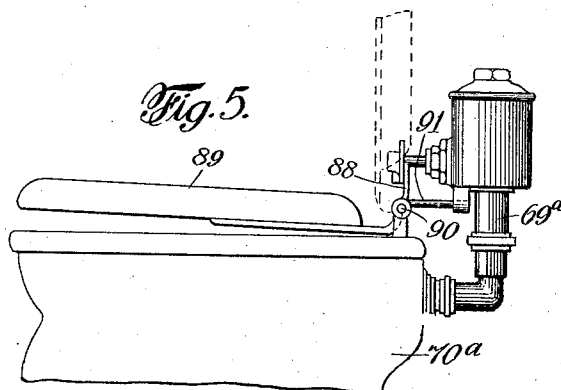
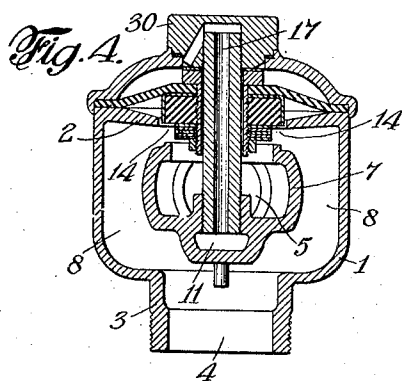
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1,614,468

HYDRAULICALLY OPERATED FLUSHING VALVE MECHANISM

Filed June 5, 1924

2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE.

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HYDRAULICALLY-OPERATED FLUSHING-VALVE MECHANISM.

Application filed June 5, 1924. Serial No. 717,960.

My invention consists in the novel features hereinafter described reference being had to the accompanying drawings which show two forms in which I have contemplated embodying my invention selected by me for purposes of illustration, and the said invention is fully disclosed in the following description and claims.

My invention relates particularly to hydraulically operated flushing valves for water closets in which the opening and closing of the flushing valve mechanism is effected by water pressure, and my invention consists in the novel features of construction and combination of parts hereinafter described, whereby both the construction of the valve mechanism is simplified, rendered more efficient and certain of operation, and whereby the valve may be installed and adjusted to accommodate variations in the pressure of water available in the connected supply main in the particular location in which the valve mechanism is installed.

In the said drawings,

Fig. 1 represents a perspective view of a portion of a closet bowl showing one form of my improved valve mechanism installed and provided with a cut off valve in connection therewith and adapted to be set in operation by hand.

Fig. 2 is a vertical sectional view of the form of valve mechanism shown in Fig. 1, including the local cut off valve (which in this instance is turned at right angles to the position in which it is shown in Fig. 1, for clearness), the flushing valve and relief valve for the back pressure chamber being shown in closed positions.

Fig. 3 is a similar view showing the relief valve and flushing valve in open positions.

Fig. 4 represents a transverse vertical sectional view of the main valve casing on line 4—4 of Fig. 3.

Fig. 5 is a side elevation of a portion of a closet bowl showing a slightly modified form of my improved valve mechanism installed in connection therewith and adapted to be automatically set in operation by the depression of the seat.

Fig. 6 is a vertical sectional view of the form of valve mechanism illustrated in Fig. 5 showing the relief valve and flushing valve closed.

Fig. 7 is a similar view showing the relief valve and flushing valve in open positions.

Fig. 8 represents a transverse vertical section through the valve casing on line 8—8 of Fig. 1.

Fig. 9 is a detail view of a strut which may be employed in connection with the form of valve shown in Figs. 5 to 8 inclusive drawn to a smaller scale.

Referring to the form of my invention illustrated in Figs. 1 to 4 inclusive, 1, represents the main valve casing which is preferably formed as a cored casting of what might be termed bowl shaped, provided on its upper end with an annular diaphragm support, 2, and at its lower end with a threaded cylindrical extension, 3, communicating with the interior of the shell and providing a flushing discharge outlet, indicated at 4. The shell, 1, is provided at one side with an internally threaded water inlet aperture, 5, and on the opposite side it is provided with an internally threaded aperture, 6, to receive the casing of the relief valve, as hereinafter described. Between the apertures 5, 6, the shell, 1, is provided with an interior shell, indicated at 7, a water passage, indicated at 8, being thus formed between the walls of the two shells, as clearly indicated in Fig. 4, extending from the annular diaphragm support, 2, to and communicating with the discharge aperture, 4. This interior shell is divided by a partition, indicated at 9, into two internal chambers, the larger of these chambers, indicated at 10, being the water inlet chamber, and communicating directly with the water inlet, 5, but is separated from the threaded opening, 6, by the partition, 9. The other of said chambers, indicated at 11, communicates with the threaded aperture, 6, and forms a part of the outlet passage for the back pressure chamber, as will hereinafter more clearly appear. The interior shell, 7, is provided at its upper portion with an aperture, indicated at 12, forming the valve controlled inlet aperture of the valve and being surrounded by an annular valve seat, 13. This seat lies just below the inner edge of the annular diaphragm support, 2, leaving a space between the two, which communicates with the main discharge passages, 8, leading to the flushing discharge aperture, 4, by

means of lateral openings, indicated at 14, in Fig. 4. The partition, 7, is provided with a vertically disposed threaded aperture, indicated at 15, into which is screwed the lower end of a vertical tubular stud, 16, having a threaded portion at each end, and a central bore or passage, indicated at 17. This stud performs three functions. In the first place it provides means for holding the cap or closing member in position and clamping the edges of the diaphragm without the use of screws or other fastening means, thus simplifying the construction of the valve, providing a smooth exterior surface at the upper portion of the same, and making it very much easier to maintain the apparatus in neat and clean condition; in the second place, it performs, in conjunction with the main flushing valve which fits around it, a minute annular orifice communicating with the back pressure chamber, as hereinafter described, to permit the filling of the back pressure chamber to effect the automatic closing of the flushing valve; and thirdly, the central bore, 17, of said stud forms a portion of the relief passage for the back pressure chamber, which is thus located centrally with respect to the flushing valve or diaphragm and prevents the necessity of providing a diaphragm with an offset portion to accommodate an offset relief passage as has been customary in this type of valve, so that the diaphragm may be made perfectly circular, which effects a considerable saving in the manufacture of the diaphragm and insures a more efficient clamping of the edges thereof.

18 represents the diaphragm which is preferably made of rubber or other suitable material and is circular in form and is provided with a central aperture through which extends a sleeve 19 having a projecting flange, 20, at its upper end, preferably hexagonal in form. To this diaphragm is secured the main flushing valve which preferably comprises a metal shell, indicated at 21, enclosing the valve proper, indicated at 22, and formed of rubber, fibre, leather or other suitable material to engage the seat, 13, the valve being held in place on the sleeve by means of a nut, 23, a series of washers, 24, being provided beneath the valve, of a size approximating very closely the diameter of the inlet aperture, 12, as clearly shown in Fig. 2. It will be readily understood that as the valve moves downward into closed position, these washers will be caused to enter the aperture, 12, in advance of the closing of the valve, 22, upon its seat, 13, and these washers therefore constitute in effect a throttling mechanism for more or less throttling down the flow of water from the main through the flushing inlet aperture, 12, so that the flow is greatly checked in advance of the actual closing of

the aperture by the valve to prevent hammering, and noise in the operation of the mechanism. As these valves are usually employed in connection with installations where there is high water pressure, and in some cases where the water pressure is exceedingly high, it is very important to thus preliminarily throttle the flow of the water before the closing of the flushing valve, and the point in the cycle of movement of the valve at which this throttling should be commenced, will depend upon the pressure of the water in the main supplying the valve mechanism. Therefore, instead of making this throttling mechanism in one piece, as it could be made, I prefer to build it up as a series of comparatively thin washers, as indicated at 24, and by varying the number of washers and consequently the vertical height of this throttling mechanism the valve mechanism can be adjusted to provide the desired gradual throttling of the water supply previous to the entire closing of the valve under the exact conditions as to water pressure, which may be present in each particular installation, and without in any way impairing the efficiency of the flushing action.

25 represents what I term the flush cap member, to distinguish it from a cap held in place by an annular series of screws, with projecting screw heads, which are usually provided in diaphragm valves. This cap member is circular in form and is provided with a downwardly extending flange, 26, within which is an annular clamping portion, 27, to engage the marginal portions of the diaphragm, 18. The central portion of the cap member is domed to provide a back pressure chamber, 28, and the cap member is provided centrally with an aperture, 29, surrounded at its upper face with an annular recess, both of which are concentric with the stud, 16. The cap member, 25, is held in position with respect to the casing and made to clamp the marginal portions of the diaphragm by means of a clamping nut, 30, provided with an internally threaded recess, 31, adapted to screw upon the upper end of the stud, 16, said nut having a shoulder for engaging an annular packing, 32, located in the annular recess surrounding the central aperture, 29, of the cap member, and thus making a tight joint between the nut and the cap member. This nut is provided with a polygonal exterior so that it may be forcibly screwed down on the stud, 16, so as to clamp the marginal portions of the diaphragm, 18, very firmly between the cap member and the upper end of the casing, 1, as clearly shown. The recess, 31, in the nut, 30, is of sufficient depth to leave a space within the same above the stud, 16, as shown in the drawings, and the nut is provided with one or more inclined passages, 33, ex-

tending from the upper end of this recess to the lower portion of the nut, and communicating with the back pressure chamber, 28. Obviously this recess also communicates with the central bore, 17, of the stud, and with the chamber, 11, previously described in the inner shell of the casing. This produces a very simple and efficient construction and leaves the portions of the cap member surrounding this nut entirely smooth and free from screws or bolts, giving it a very attractive appearance and making it very much easier to keep it in a clean and sanitary condition. It also greatly facilitates the removal of the cap member for examination or repair of the valve mechanism as there is only one threaded device to unscrew.

The casing, 1, is provided with a suitable relief valve mechanism for the back pressure chamber, which in the form of my invention illustrated in Figs. 1 to 4 inclusive, is operated manually. I prefer to form this relief valve mechanism as a unit capable of being screwed into the threaded opening, of the valve casing, after it has been brought into fully assembled relation, although this is not absolutely essential. As illustrated in the drawings, Figs. 1 to 4 inclusive, the manually operated relief valve unit comprises the following members. 34 represents a cylindrical sleeve threaded on its exterior to engage the threaded aperture, 6, and provided at its inner end with an inwardly extending annular flange, 35, having a recessed portion on its outer face to receive a washer, 36, the outer marginal portions of which are clamped between the said flange, 35, and the portions of the casing, 1, at the inner end of the threaded recess, 6. The inner marginal portions of this washer form a valve seat for the relief valve, 37, the stem of which extends through the central aperture in said washer, and the flange, 35, and has a threaded portion engaged by a hollow sliding plunger, 38, carried by an extension sleeve, 39, screwed into the outer end of the valve sleeve, 34. The outer end of the extension sleeve, 48, is provided with an aperture to receive the inner end of a removable handle, 39, provided with a disc portion, 40, within the extension sleeve and held therein by annular flanges around the outer aperture of said extension sleeve, said disc engaging on its face, the plunger, 38. The inner portion of the plunger is of less diameter than the outer end and is surrounded by a retracting spring, 41, the inner end of which engages a metal annulus, 42, clamped between the edges of the sleeves, which edges also serve to clamp the marginal edges of a flexible diaphragm, 43, having a central aperture engaging an eyelet secured to the stem of the relief valve between the inner end of the plunger and a shoulder on

the valve stem to protect said spring from becoming rusted or corroded by contact with water. A second spring of smaller diameter, indicated at 44, is interposed between the disc, 40 of the handle, and the plunger, and in this instance extends into the portion of the plunger of lesser diameter and surrounds the threaded portion of the relief valve stem. The sleeve, 34, is provided with one or more apertures, 45, adapted to communicate with a branch relief passage, 46, within the casing, 1, communicating with the discharge outlet, 4, as clearly shown in Figs. 2 and 3. It will be readily seen that by moving the handle 39, laterally, as indicated in Fig. 3, the plunger, 38, will be moved forward, together with the relief valve, and that by releasing the handle, the plunger will be returned with the relief valve by the spring, 41, and the handle will be restored to its normal position by the spring, 44. It will also be seen that the relief valve mechanism can be assembled as a unit and applied to the valve casing by screwing the threaded end of the sleeve, 34, into the threaded aperture, 6, a suitable washer of lead or other material being provided between the sleeve and the casing to further prevent leakage.

In the operation of this form of my improved valve mechanism it will be understood that the inlet aperture, 5, of the valve casing is connected with the water supply main, which is to supply the flushing water under pressure. In order that the interior parts of the valve mechanism may be removed for examination and repair when desired, I preferably combine with my improved valve mechanism, a local cut off valve so that this may be done without interfering with any other parts which may be connected to the same water main. In this instance I have shown such a cut off valve, comprising a valve casing, 50, provided with an internally threaded inlet aperture, 51, to receive a pipe connection from the water main and having opposite thereto a threaded aperture, 52, to receive a sleeve, 53, externally threaded and provided with an internally threaded recess, 54, and a central aperture, 55. 56 represents the cut off valve which is carried by an externally threaded valve stem 57, having a steep pitch, which in turn engages a corresponding internally threaded recess in a sleeve, 58, which extends through the opening, 55, in the sleeve, 53. the latter sleeve being provided with a packing ring, 59, and a gland, 60, in order to form a tight joint around said sleeve, 58. The lower end of the stem, 57, is provided with a guiding and valve supporting polygonal head, 61, adapted to be retained against rotary movement by lateral guiding faces, 62, formed in the interior of the cut off valve casing above the valve seat, 63, upon which the valve, 56, seats. The rotary valve actuating sleeve, 130

58, has its outer end provided with some means by which it can be rotated. I find it convenient to simply drill a transverse hole through the outer end of the sleeve, as indicated at 64, to receive a nail or spike, but any other suitable means for turning the sleeve can be employed. It will be readily understood that by rotating the sleeve, 58, the cut off valve can be quickly moved into closed position, or opened, as may be desired. As indicated in Fig. 1, where the valve mechanism is so installed that the cut off valve can be placed in horizontal position, I find it convenient to provide a rubber buffer, indicated at 65, and shown in section in Fig. 2, this buffer being omitted in Fig. 3. This buffer will act as a cushion support for the seat, 66, when the latter is in vertical position, but this of course is not essential. Fig. 1 represents a convenient installation where the inlet pipe is entirely concealed in the wall or behind the wall. In this figure 67 represents the water inlet pipe connected to the inlet aperture, 51, of the cut off valve, which is in turn connected to the inlet aperture, 5, of the main valve casing by a union, 68, in a well known manner, and the discharge aperture, 4, of the main valve casing is connected to and supported by the flushing pipe, 69, which communicates with the bowl, 70.

The parts being in the position as indicated in Fig. 2, water under pressure will be admitted to the interior of the inlet chamber, 10, of the valve casing, a certain quantity of water will have passed upwardly between the sleeve, 19, and the central stud, 16, into the back pressure chamber, which is therefore filled with water at the same pressure as the main, and as the back pressure chamber is of greater diameter than the aperture, 12, the valve, 22, will be maintained in closed position. The relief valve, it will be understood, is also maintained in closed position by its retracting spring. When it is desired to flush the bowl the handle, 39, is moved laterally in any direction, thereby opening the relief valve, 37, as indicated in Fig. 3. This permits the water in the back pressure chamber, 28, to pass up through the inclined passage, or passages, 33, in the nut, 30, into the recess, 31, and thence down through the bore, 17, of the stud, 16, into the chamber, 11, of the inner shell, thence through the opening controlled by the relief valve, into the relief valve casing, 34, and thence through the aperture, 45, in the side of the casing and passage, 46, in the main valve casing, to the discharge aperture, 4, of the latter. The water in the back pressure chamber, 28, will be immediately forced out through the channel indicated on account of the pressure of the incoming water on the lower face of the flushing valve, 22, which rises, carrying with it the central portion of the diaphragm, 18,

until the opening movement of the valve is arrested by contact of the upper end of the valve sleeve, 19, with the lower face of the nut 30. When the water pressure is very high, it may be desirable to prevent the valve from opening quite as far as when the water pressure is not so high, and in order to accommodate variations in the water pressure, I prefer to employ one or more washers surrounding the stud, 16, and interposed between the top of the sleeve, 19, and the nut, 30. In the drawings I have shown one such washer, at 47, although I may use two or more as circumstances may require. These washers constitute an adjustable stop for limiting the upward movement of the valve. With the flushing valve in open position, as indicated in Fig. 3, the incoming water passes through the aperture, 12, in the upper end of the inner shell and laterally through the passages, 14, and downwardly through the lateral passages, 8, between the inner and outer shells of the valve casing, as clearly shown in Fig. 4, to the discharge opening or passage, 4, and thence to the bowl to effect the flushing action. In this form of my invention the flushing will continue as long as the relief valve is held open and for a short period after the relief valve is closed, upon the release of the handle, 39, during which time the flushing valve, 22, is closing. When the handle is released, the relief valve, 37, will be instantly closed by the action of its retracting spring, 41, and water will begin to accumulate in the back pressure chamber, passing upwardly thereto between the valve sleeve, 19, and the central stud, 16, which forms a minute annular passage communicating between the back pressure chamber, 28, and the inlet chamber, 10. As the pressure increases in the back pressure chamber, 28, it acts upon the upper face of the diaphragm which, as before stated, is of considerably greater area than the valve and gradually depresses the diaphragm and the flushing valve, 22. As the valve, 22, closes, the throttling projection thereon, formed preferably by the plurality of washers, 24, will descend into the aperture, 12, and throttle the flow of water therethrough, which flow will become less and less until the valve, 22, is firmly but gently seated on the valve seat 13, when all the flow ceases. The throttling of the stream of water performs another function in providing for the "after fill" as it is termed, and insures that immediately before the final closing of the valve, there will be a discharge of a sufficient quantity of water at moderate speed which will refill the bowl after the flushing action and leave it in filled condition.

It will be noted that should it be desirable to open the main valve casing for examination or repair, it is only necessary to turn the sleeve, 58, of the auxiliary cut off valve, 130

and thereby force downward the cut off valve, 56, until it engages its seat, 63, when the main valve casing will be entirely disconnected from the water supply. The nut 5 30, can then be removed which will permit the removal of the diaphragm, valve and central stud, if desired. In this manner the valve may be tested when it is installed and the proper number of washers, 24 and 47, ap- 10 plied to insure the accurate and proper functioning of the valve mechanism under the particular water pressure with which it is to be used. The relief valve unit may also be unscrewed from the main casing and 15 the parts separated for examination and repair if necessary.

In Figs. 5 to 9 inclusive I have shown a slight modification of my invention, which is adapted particularly for use where the 20 valve mechanism is to be operated by the vertical movement of the seat, instead of manually. Referring to these figures, 1^a, represents the main valve casing, provided at its upper end with the annular dia- 25 phragm support, 2^a, and at the lower end with a discharge aperture, 4^a, in this instance internally screw threaded, as indicated at 3^a. The main casing is provided with a water inlet, indicated at 5^a (Fig. 8) 30 for admitting water to the inlet chamber, indicated at 10^a, which communicates with an interior shell, 7^a, provided at its upper end with the main flushing aperture, 12^a, surrounded by the valve seat, 13^a. This 35 aperture, 12^a, communicates by the openings, 14^a, with the lateral water passages, 8^a, extending downwardly around the inner shell and communicating with the discharge aperture, 4^a. The lower end of the shell, 7^a, 40 is provided with the threaded aperture, 15^a, into which is screwed the lower end of the stud, 16^a, having a vertical bore, 17^a, forming part of the relief passage. 18^a represents the diaphragm carrying the valve sleeve, 45 19^a, provided at its upper end with the flange, 20^a, said sleeve being provided with the valve casing, 21^a, valve, 22^a, throttling washers, 24^a, and nut, 23^a, the diaphragm being clamped by the cap member, 25^a, 50 which is held in position by the nut, 30^a, screwed on the upper end of the stud, 16^a, and provided with the inclined relief passage, 33^a, all constructed and operating substantially as hereinbefore described with 55 reference to Figs. 1 to 4 inclusive. In this form of the valve mechanism, I employ a slightly different form of relief valve mechanism, as the relief valve is to be operated by the seat. The main valve casing is 60 provided with coaxial apertures, 6^a—6^b, the latter being internally screw threaded and being formed in a partition wall extending downwardly from the inner shell. 34^a represents a guiding sleeve which extends 65 through the opening, 6^a—6^b, and has an ex-

terior threaded portion which screws into the threaded opening, 6^b, said sleeve being provided with an exterior flange and pack- ing washer to engage the exterior of the cas- ing and make a tight joint. The outer end 70 of the sleeve is also provided with a guid- ing aperture, 71, through which extends the seat operated valve stem, 72, the outer end of said sleeve being also provided with a 75 packing recess, 73, and gland, 74, surround- ing said valve stem. The inner end of the sleeve, 34^a, is provided with a valve seat, in- dicated at 75, and the lateral walls of the sleeve are provided with water apertures, 76, which communicate with the lateral pas- 80 sages, 8^a, so that all the flushing water must pass through the sleeve, 34^a. The valve stem, 72, is provided at its inner end with a valve, 77, to engage the valve seat, 75, when the stem is drawn outwardly so as to close the 85 opening within the valve seat and prevent the passage of any flushing water through the valve casing. The valve, 77, is con- veniently made of rubber, fibre or other suitable material, supported by a metallic 90 disc, 78, and on the rear face of the disc, 78, is a cylindrical extension, 79, carrying at its inner end the relief valve, 80, which is prefer- ably of rubber, fibre or other suitable material. The cylindrical extension, 79, 95 extends over a short nipple, 81, having a longitudinal passage therethrough commu- nicating with a recess, 82, in the valve chamber, which is connected by means of an inclined passage, 83, with a small chamber, 100 84, at the bottom of the stud, 16^a. For convenience in forming the passage, 83, and the bore of the nipple, 81, the recess, 82 is cored in the main shell or casting of the valve, and after the passage, 83, and the 105 nipple, 81, are drilled, this recess is closed by threaded plug, indicated at 85. The relief valve 80, is normally held in closed position, as shown in Fig. 6, and the interior shut off valve, 77, held in open position by 110 means of a spring acting on the valve stem, 72. In this instance the spring, indicated at 41^a, is shown as a coil spring surrounding the stem, 72, within the sleeve, 34^a, but it might be located otherwise, if desired. The 115 outer end of the valve stem 72, is provided with a suitable head, indicated at 86, screwed thereon, and fastened by set screw, 87, which engages a forked operating lever, 88, secured to the seat, 89, and projecting up- 120 wardly from the hinge pin, 90, so that when the seat is depressed, the lever, 88, will draw the valve stem, 72, outwardly, opening the relief valve and closing the interior shut off valve, 77, as indicated in Fig. 7. In 125 Fig. 5 I have shown my improved valve installed in connection with a closet bowl, the water outlet, 4^a, being connected by means of a pipe, 69^a, with the bowl, 70^a, and a strut, 91, being inserted between the hinge pin, 90 130

and the main valve casing, to relieve the pipe connections from strain when the valve is operated by the depression of the seat. The strut, 91, is provided at its rear end with a threaded portion to screw into a lug, 92, secured to the main valve shell or casing, and having a threaded aperture therein to receive the strut. The forward end of the strut is provided with an eye, or with a bifurcated portion to engage the hinge pin, 90. A detail of one form of this strut is shown in Fig. 9.

It will be understood that the water inlet aperture, 5^a, is connected to the water main. In the present instance I have shown a short section of the inlet pipe, 67^a, provided with a union, 68^a, by which it may be connected to the adjacent pipe section of the main.

The operation of this form of my flushing valve will be as follows. Fig. 6 represents the normal position of the valve mechanism, the relief valve, 80, being closed, and the flushing valve being held in closed position by the accumulated pressure in the back pressure chamber, 28^a. When the seat is depressed, the valve stem, 72, will be drawn outward, as indicated in Fig. 7, so as to open the relief valve, 80, and simultaneously close the interior cut off valve, 77, within the main flushing valve casing, thereby closing the inner end of the sleeves, 34^a, and preventing the delivery of any flushing water from the discharge outlet, 4^a, so long as the seat remains in depressed position, and thus preventing waste of water. As soon as the relief valve is opened, however, the water in the back pressure chamber will pass out through the channel provided for it and the main flushing valve will be elevated into the open position, as indicated in Fig. 7. The parts will remain in this position so long as the seat is depressed and no flushing water can pass through the valve casing or be discharged therefrom, although the main flushing valve is open. As soon as the pressure is removed from the seat, 89, it will be raised by the spring, 41^a, which also serves as a retracting spring for the valve stem, 72, thus opening the valve, 77, and closing the relief valve, 80. As the flushing valve is open already, water will commence to flow through the bowl for flushing purposes instantly upon the opening of the valve, 77, effecting the flushing action, and as soon as the relief valve, 80, is closed upon the end of the nipple, 81, the pressure will have commenced to build up in the back pressure chamber, 28^a, portions of the incoming water passing up between the sleeve, 19^a, and the stud, 16^a, and gradually effecting the closing of the main flushing valve, 22^a, upon its seat, 13^a. By varying the number of washers, 24^a and 47^a, as hereinbefore described with reference to

Figs. 1 to 4 inclusive, the duration of the flush can be accurately regulated, and also the throttling action of the washers, 24^a, according to the particular water pressure employed with the installation.

It will be understood that I may also employ in connection with this valve mechanism illustrated in Figs. 5 to 8 inclusive, the exterior local cut off valve mechanism illustrated in Figs. 1, 2 and 3, if this is found desirable or convenient although I have not illustrated the exterior cut off valve in Figs. 5 to 8 as it seemed to be unnecessary to duplicate this illustration.

What I claim and desire to secure by Letters Patent is:—

1. In a hydraulically operated flushing valve mechanism, the combination of a valve casing provided with a water inlet, a flushing discharge aperture, a flushing valve, and a back pressure chamber for closing the valve and holding it normally in closed position, a diaphragm connected to said valve and forming one wall of the back pressure chamber, a detachable cap member forming the other wall of the back pressure chamber, a stationary stud secured to the valve casing and extending through said valve and said back pressure chamber and detachably connected with said cap, said stud being provided with a longitudinal passage communicating with the back pressure chamber and forming part of a relief passage therefor, the said flushing valve being movable longitudinally with respect to the stud, and a relief valve for controlling the discharge of fluid from the back pressure chamber.

2. In a hydraulically operated flushing valve mechanism, the combination of a valve casing provided with a water inlet, a flushing discharge aperture, a flushing valve, and a back pressure chamber for closing the valve and holding it normally in closed position, a diaphragm connected to said valve and forming one wall of the back pressure chamber, a stationary stud secured to the valve casing and extending through said valve and said back pressure chamber, said stud being provided with a longitudinal passage communicating with the back pressure chamber and forming part of a relief passage therefor, the said flushing valve being movable longitudinally with respect to the stud, said valve body being provided with a detachable cap member, clamping means having a threaded engagement with said stud, and engaging said cap member for holding it in operative position, and a relief valve for controlling the discharge of fluid from the back pressure chamber.

3. In a hydraulically operated flushing valve, the combination of a valve casing provided with inlet and outlet apertures, an intermediate flushing valve aperture provided

with a seat, a flushing valve engaging said seat, a back pressure chamber, a diaphragm forming a wall of the back pressure chamber and connected to the valve, a detachable cap member forming the other wall of the back pressure chamber, a stationary stud secured to the valve extending through the valve and back pressure chamber and providing a water inlet for the back pressure chamber, between the stud and said valve, means for detachably securing said cap member to said stud, a relief valve for the back pressure chamber, and a throttling device connected to said flushing valve and normally extending into the flushing valve aperture, said throttle device comprising a plurality of detachable parts rigidly secured to the valve to permit of varying the size of said throttling device, to adjust the valve for different water pressures.

4. In a hydraulically operated flushing valve, the combination of a valve casing provided with inlet and outlet apertures, an intermediate flushing valve aperture provided with a seat, a flushing valve engaging said seat, a back pressure chamber, a diaphragm forming a wall of the back pressure chamber and connected to the valve, a detachable cap member forming the other wall of the back pressure chamber, a stationary stud secured to the valve casing extending through the valve and back pressure chamber and providing a water inlet for the back pressure chamber between the stud and said valve, means for detachably securing said cap member to said stud, a relief valve for the back pressure chamber, and a plurality of detachable washers secured to said valve around said stem and extending into the flushing valve aperture to form throttling mechanism for the flushing valve aperture and to permit of the adjustment of said throttling mechanism according to the water pressure.

5. In a hydraulically operated flushing valve, the combination of a valve casing provided with a water inlet and outlet, an intermediate flushing valve aperture and seat, and a back pressure chamber, a stud extending through said seat and back pressure chamber, a flushing valve for engaging said seat provided with a sleeve extending through the same and engaging said stud, and providing an annular passage between the sleeve and stud for supplying water to the back pressure chamber, a diaphragm secured to said valve and forming one wall of the back pressure chamber, said stud being provided with a longitudinal passage communicating with the back pressure chamber, and forming part of a relief passage therefor, a cap member having marginal portions for engaging and clamping the marginal portions of the diaphragm, a nut secured to said stud and clamping the cap

member in operative position upon the diaphragm and valve body, and a relief valve for the back pressure chamber.

6. In a hydraulically operated flushing valve, the combination of a valve casing provided with a water inlet and outlet, an intermediate flushing valve aperture and seat, and a back pressure chamber, a stud extending through said seat and back pressure chamber, a flushing valve for engaging said seat provided with a sleeve extending through the same and engaging said stud, and providing an annular passage between the sleeve and stud for supplying water to the back pressure chamber, a diaphragm secured to said valve and forming one wall of the back pressure chamber, said stud being provided with a longitudinal passage forming part of a relief passage therefor, a cap member having marginal portions for engaging and clamping the marginal portions of the diaphragm, a nut secured to said stud and clamping the cap member in operative position upon the diaphragm and valve body, said nut being provided with a passage for connecting the longitudinal passage in said stud with the back pressure chamber, and a relief valve for the back pressure chamber.

7. In a hydraulically operated flushing valve, the combination of a valve casing provided with a water inlet and outlet, an intermediate flushing valve aperture and seat, and a back pressure chamber, a stud extending through said seat and back pressure chamber, a flushing valve for engaging said seat provided with a sleeve extending through the same and engaging said stud, and providing an annular passage between the sleeve and stud for supplying water to the back pressure chamber, a diaphragm secured to said valve and forming one wall of the back pressure chamber, said stud being provided with a longitudinal passage communicating with the back pressure chamber and forming part of a relief passage therefor, a cap member having marginal portions for engaging and clamping the marginal portions of the diaphragm, a nut secured to said stud and clamping the cap member in operative position upon the diaphragm and valve body, variable means for limiting the movement of the valve on said stud in the direction to open the same, and a relief valve for the back pressure chamber.

8. In a hydraulically operated flushing valve, the combination of a valve casing provided with a water inlet and outlet, an intermediate flushing valve aperture and seat, and a back pressure chamber, a stud extending through said seat and back pressure chamber, a flushing valve for engaging said seat provided with a sleeve extending through the same and engaging said stud,

and providing an annular passage between the sleeve and stud for supplying water to the back pressure chamber, a diaphragm secured to said valve and forming one wall of the back pressure chamber, said stud being provided with a longitudinal passage communicating with the back pressure chamber and forming part of a relief passage therefor, a cap member having marginal portions for engaging and clamping the marginal portions of the diaphragm, and a nut secured to said stud and clamping the cap member in operative position upon the diaphragm and valve body, and a detachable washer surrounding said stud and interposed between the valve sleeve and said nut for limiting the opening movement of the valve.

9. In a hydraulically operated flushing valve, the combination of a valve casing provided with a water inlet and outlet, an annular diaphragm support and an interior shell communicating with said inlet and provided with a flushing valve aperture, and a seat located below said diaphragm support, said casing having water passages exterior to the inner shell communicating with said valve aperture when the flushing valve is open, and leading to the said outlet, a diaphragm above the diaphragm support, a flushing valve connected with said diaphragm and provided with a sleeve extending through said valve and diaphragm, a stud secured to said inner shell and extending through said sleeve, a cap member forming a back pressure chamber having marginal clamping portions for engaging the diaphragm, a threaded clamping device for said cap member engaging the said stud, said stud being provided with a longitudinal passage communicating with the back pressure chamber and forming part of a relief passage therefor, and a relief valve for said back pressure chamber.

10. In a hydraulically operated flushing valve, the combination of a valve casing provided with a water inlet and outlet, an annular diaphragm support and an interior shell communicating with said inlet and provided with a flushing valve aperture, and a seat located below said diaphragm support, said casing having water passages exterior to the inner shell communicating with said

valve aperture when the flushing valve is open, and leading to the said outlet, a diaphragm above the diaphragm support, a flushing valve connected with said diaphragm and provided with a sleeve extending through said valve and diaphragm, a stud secured to said inner shell and extending through said sleeve, a cap member forming a back pressure chamber having marginal clamping portions for engaging the diaphragm, a threaded clamping device for said cap member engaging the said stud, said stud being provided with a longitudinal passage communicating at its upper end with the back pressure chamber, said casing being provided with means for connecting the lower end of said longitudinal passage of the stud, with the water outlet, and a relief valve located adjacent to said outlet.

11. In a hydraulically operated flushing valve, the combination of a main valve casing provided with inlet and outlet apertures, and having an annular diaphragm support, and an inner shell communicating with said inlet and having a flushing aperture and valve seat below the diaphragm support and providing water passages leading from said flushing aperture around said inner shell to the outlet, a diaphragm on said diaphragm support, a flushing valve for engaging said seat connected with said diaphragm and having a guiding aperture extending through said valve and diaphragm, a stud secured at its lower end to said inner shell and extending through said guiding aperture and providing an annular passage from the inlet, a cap member providing a back pressure chamber and having marginal clamping portions, a clamping device for said cap member having a threaded engagement with said stud, said stud having a longitudinal passage communicating with the back pressure chamber, and forming part of a relief passage therefor, a normally closed relief valve for the back pressure chamber, a normally open cut off valve connected with said relief valve, a spring for holding said valves in their normal positions, and seat actuated means for simultaneously opening the relief valve and closing the cut off valve.

In testimony whereof I affix my signature.
PHILIP HAAS.